CLAIMS:

1. A method of quantifying measurements associated with a subject using a visual image of the subject, the method comprising the steps of:

acquiring a digital representation of a first image of the subject, the first image being acquired at a first time, the digital representation of the first image including visual information associated with the first image;

acquiring a digital representation of a second image of the subject, the second image being acquired at a second time, the digital representation of the second image including visual information associated with the second image;

determining difference information, the difference information representing a change in at least one visual parameter between the digital representation of the first image and the digital representation of the second image; and

converting the difference information into subject information, the subject information representing at least one of a physical change, chemical change, electrical change, and electrochemical change associated with the subject.

2. A method of quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 1, further comprising the step of adding a visual indicator to the subject, the visual indicator changing at least one visual

parameter in response to the at least one of the physical change, chemical change, electrical change, and electrochemical change associated with the subject.

3. A method of quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 1, wherein the subject information includes at least one of pH, lead content, zinc content, potential difference, pitting, and corrosion.

4. A method of quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 1, wherein the at least one visual parameter includes at least one of color, tint, hue, brightness, shade, and tone.

5. A method of quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 1, further comprising the step of adding an offset to at least a portion of the difference information.

6. A method of quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 1, further comprising the step of multiplying at least a portion of the difference information by a gain.

7. A method of quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 1, further comprising the step of acquiring analog information associated with the subject.

8. A method of quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 7, wherein the step of acquiring analog information further comprises the step of acquiring at least one of voltage information and current information using a potentiostat.

9. A method of quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 1, further comprising the steps of:

comparing at least a portion of the difference information to a threshold value; and

associating that portion of the difference information that is one of less than and greater than the threshold value with a region of interest, the region of interest being associated with the subject.

10. A method of quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 9, further comprising the step of substituting a predetermined value for that portion of the difference information that is not within the region of interest.

11. A method of quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 1, further comprising the step of generating a histogram, the histogram being representative of an intensity as a function of a quantity of pixels having the intensity, the histogram being representative of at least a portion of at least one of the first image and the second image.

12. A method of quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 11, further comprising the step of determining a peak value of the histogram as a function of time.

13. A method of quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 1, further comprising the step of

overlaying at least a portion of the difference information on at least one of the first image and the second image to yield a processed image.

14. A method of quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 1, further comprising the step of illuminating the subject with at least one of a monochromatic light and a polychromatic light.

15. A method of quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 1, further comprising the step of acquiring the first image and the second image using at least one of a black and white camera and a color camera.

16. A method of quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 1, wherein each of the first image and the second image includes at least one pixel, the at least one pixel associated with the first image including a first RGB value, the at least one pixel associated with the second image including a second RGB value, wherein the step of converting difference information further comprises the steps of:

converting the first RGB value into a first rgb tristimulus value and converting the second RGB value into a second rgb tristimulus value in accordance with the equations

$$r = R/(R+G+B) \quad (49)$$

$$g = G/(R+G+B) \quad (50)$$

$$b = B/(R+G+B) \quad (51)$$

R representing an intensity of red associated with the at least one pixel, G representing an intensity of green associated with the at least one pixel, B representing an intensity of blue associated with the at least one pixel, r representing a red tristimulus value, g representing a green tristimulus value, b representing a blue tristimulus value;

converting the first rgb tristimulus value into a first spectral power distribution and converting the second rgb tristimulus value into a second spectral power distribution in accordance with the equation

$$\text{spectral power distribution} = r\,\underline{\mathbf{r}} + g\,\underline{\mathbf{g}} + b\,\underline{\mathbf{b}} \qquad (52)$$

$\underline{\mathbf{r}}$ representing a red color matching function, $\underline{\mathbf{g}}$ representing a green color matching function, $\underline{\mathbf{b}}$ representing a blue color matching function, the first spectral power distribution including at least one first spectral power element, the second spectral power distribution including at least one second spectral power element;

obtaining an equation representing the subject information as a function of at least one spectral power distribution peak, the at least one spectral power distribution peak being associated with the first spectral power distribution;

subtracting the at least one first spectral power element and the at least one second spectral power element to yield a difference spectral power element; and

multiplying the difference spectral power element by a derivative of the equation representing the subject information as a function of the at least one spectral power distribution peak to represent the at least one of the physical change, chemical change, electrical change, and electrochemical change associated with the subject.

17. A method of quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 1, wherein each of the first image and the second image includes a plurality of pixels, each of the plurality of pixels associated with the first image including a first RGB value, each of the plurality of pixels associated with the second image including a second RGB value, wherein the step of converting the difference information further comprises the steps of:

converting the first RGB values into first rgb tristimulus values and converting the second RGB values into second rgb tristimulus values in accordance with the equations

$$r = R/(R+G+B) \quad (49)$$

$$g = G/(R+G+B) \quad (50)$$

$$b = B/(R+G+B) \quad (51)$$

R representing an intensity of red associated with the at least one pixel, G representing an intensity of green associated with the at least one pixel, B representing an intensity of blue associated with the at least one pixel, r representing a red tristimulus value, g representing a green tristimulus value, b representing a blue tristimulus value;

converting the first rgb tristimulus values into first spectral power distributions and converting the second rgb tristimulus values into second spectral power distributions in accordance with the equation

$$\text{spectral power distribution} = r\,\underline{\mathbf{r}} + g\,\underline{\mathbf{g}} + b\,\underline{\mathbf{b}} \quad (52)$$

$\underline{\mathbf{r}}$ representing a red color matching function, $\underline{\mathbf{g}}$ representing a green color matching function, $\underline{\mathbf{b}}$ representing a blue color matching function;

multiplying first spectral power distribution peaks associated with the first spectral power distribution to yield a first spectral power distribution peak product;

multiplying second spectral power distribution peaks associated with the second spectral power distribution to yield a second spectral power distribution peak product;

subtracting the first spectral power distribution peak product and the second spectral power distribution peak product to yield a difference spectral power distribution peak product;

obtaining an equation representing the subject information as a function of the first spectral power distribution peak product; and

multiplying the difference spectral power distribution peak product by a derivative of the equation representing the subject information as a function of the first spectral power distribution peak product to represent the at least one of the physical change, chemical change, electrical change, and electrochemical change associated with the subject.

18. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, the apparatus comprising:

a digital camera, the digital camera acquiring a digital representation of a first image of a subject, the first image being acquired at a first time, the digital representation of the first image including visual information associated with the first image, the digital camera acquiring a digital representation of a second image of the subject, the second image being acquired at a second time, the digital representation of the second image including visual information associated with the second image; and

a computer, the computer being responsive to the digital representations of the first image and the second image, the computer determining difference information representing a change in the at least one visual parameter between the digital representation of the first image and the digital representation of the second image, the computer converting the difference information into subject information representing at least one of a physical change, chemical change, electrical change, and electrochemical change associated with the subject.

19. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 18, wherein a visual indicator is added to the subject, the visual indicator changing at least one visual parameter in response to the at least one of the physical change, chemical change, electrical change, and electrochemical change associated with the subject.

20. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 18, wherein the subject information includes at least one of pH, lead content, zinc content, potential difference, pitting, and corrosion.

21. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 18, wherein the at least one visual parameter includes at least one of color, tint, hue, brightness, shade, and tone.

22. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 18, wherein the visual

information is associated with at least two of a red color plane, green color plane, and blue color plane for each pixel of at least one of the first image and the second image.

23. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 18, wherein the computer adds an offset to at least a portion of the difference information.

24. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 18 wherein the computer multiplies at least a portion of the difference information by a gain.

25. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 18, further comprising a potentiostat, the computer being responsive to the potentiostat, the potentiostat acquiring analog information associated with the subject.

26. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 25, wherein the potentiostat acquires at least one of voltage information and current information.

27. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 18, wherein the computer compares at least a portion of the difference information to a threshold value, the computer associating that portion of the difference spectral information that is one of less than and greater than the threshold value with a region of interest, the region of interest being associated with the subject.

28. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 27, wherein the computer substitutes a predetermined value for that portion of the difference spectral information that is not within the region of interest.

29. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 18, wherein the computer generates a histogram, the histogram being representative of intensity as a function of a quantity of pixels having the intensity, the intensity being associated with at least one of the at least two colors, the histogram being associated with at least a portion of at least one of the first image and the second image.

30. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 29, wherein the computer determines a peak value of the histogram as a function of time, the peak value being associated with at least one of the at least two colors.

31. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 18, wherein the computer superimposes at least a portion of the difference information on at least one of the first image and the second image to yield a processed image.

32. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 18, further comprising a camera positioning bracket, the camera positioning bracket being mechanically coupled to the

digital camera, the camera positioning bracket selectively positioning the digital camera in at least one of an x, y, and z direction.

33. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 18, further comprising a subject positioning bracket, the subject positioning bracket being mechanically coupled to the subject, the subject positioning bracket selectively positioning the subject in at least one of an x, y, and z direction.

34. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 18, further comprising an illumination source including at least one of a monochromatic light and a polychromatic light.

35. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, as defined by Claim 18, further comprising at least one of a black and white camera and a color camera used to acquire the first image and the second image.

36. A method of quantifying measurements associated with a subject using a visual image of the subject, the method comprising the steps of:

adding a visual indicator to a subject, the indicator changing at least one visual parameter in response to at least one of a physical change, chemical change, electrical change, and electrochemical change associated with the subject;

acquiring a digital representation of a first image of the subject, the first image being acquired at a first time, the digital representation of the first image including visual information associated with the first image;

acquiring a digital representation of a second image of the subject, the second image being acquired at a second time, the digital representation of the second image including visual information associated with the second image;

determining difference information, the difference information representing a change in the at least one visual parameter between the digital representation of the first image and the digital representation of and the second image;

converting the difference information into physical information, the subject information representing the at least one of the physical change, chemical change, electrical change, and electrochemical change associated with the subject;

adding an offset selectively to at least a portion of the difference information;

multiplying at least a portion of the difference information selectively by a gain; and

displaying a processed image, the processed image including at least a portion of the difference information.

37. An apparatus for quantifying measurements associated with a subject using a visual image of the subject, the apparatus comprising:

a digital camera, the digital camera acquiring a digital representation of a first image of a subject, the first image being acquired at a first time, the digital

representation of the first image including visual information associated with the first image, the digital camera acquiring a digital representation of a second image of the subject, the second image being acquired at a second time, the digital representation of the second image including visual information associated with the second image; and

a computer, the computer being responsive to the digital representation of the first image and the second image, the computer determining difference information representing a change in the at least one visual parameter between the digital representation of the first image and the digital representation of the second image, the computer selectively adding an offset to at least a portion of the difference information, the computer selectively multiplying at least a portion of the difference information by a gain, the computer converting the difference information into subject information representing at least one of a physical change, chemical change, electrical change, and electrochemical change associated with the subject.